

# **Reform of National Systems of Electricity Generation & Transmission**

## **Power Plant Maintenance and Operation**

# Maintenance Program for Year 2012-2013

Power Plants Type (In Operation)	Minor	Hot Path	ISO/Rated (Total Cap MW)	Current Power (Total MW)	Expected Power (Total MW)	Power Added (Total MW)
(50 units) Fr5	53	14	1000	608	800	192
(10 units) Fr6	2	8	382	153	280	127
(12 units) Fr9	5	12	1476	1058	1170	112
(6 units)Siemens V94.2	8	2	954	520	620	100
(1unit)Siemens V94.3	1	-	260	150	180	30
(1unit) Siemens V64.3	1	-	65	40	45	5
(5 units) ABB	2	4	315	147	225	78
(7 units) Fiat	11	6	263	175	210	35
(12units) LM6000	10	-	565	318	400	82
Total	93	46	5280	3169	3930	761

# Rehabilitation & Maintenance of (Out of Operation Units)

The table below shows the expected power that will be gained from the units which they are out of operation due different reasons after doing the maintenance or overall refurbishment.

Power Plants Type (Out of Operation)	ISO/Rated (Total Cap MW)	Expected Power (Total MW)
(9 units) Fr5	180	153
(2 units) Fr6	80	60
(1 units) ABB	63	45
(3 units) LM6000	169	90
(4 units) Baiji Mobile	80	72
Baiji TPP		
Baghdad south TPP		
Dorah TPP		
Nassiriyah TPP		
Hartha TPP		
Total power added		420 + the power of TPP

# Ambient Temperature and Air Cooling Systems

---

## Benefits of Utilizing a Fogging, Evaporative and Chiller Systems

- Immediate Measurable Power Augmentation (20%~ 30%) with no Extra Cost.
- Lower Heat Rate.
- Reduced NO<sub>x</sub> levels .
- Rapid Temperature Drop .
- Low Operating & Maintenance Costs.
- Increased Compressor Wash and Maintenance intervals .
- Minimum Turbine Downtime .
- Practically no Induced Inlet Pressure Drop.
- Low Capital Cost and Rapid Payback.

# Power Added by Using Cooling Technologies

Power Plants Type	ISO/Rated Cap MW	Expected Power After Maintenance (MW)	Expected Increased Power After Fogging (MW)	Power Added
(59units) Fr5	1180	940	1060	122
(12 units) Fr6	462	300	360	60
(10 units) Fr9	1230	970	1070	100
(6 units)Siemens V94.2	954	620	700	80
(1unit)Siemens V94.3	260	180	215	35
(1unit) Siemens V64.3	65	45	50	5
(6 units) ABB	378	250	300	50
(7 units) Fiat	263	210	235	21
(10units) LM6000	430	300	380	80
Total	5222	3815	4370	553

# Dust and Self-Cleaning Systems

---

- Our plants using different types of filters, but unfortunately some of them are locally manufactured and they are without an international certificate to insure their ability to work in our environment.
- Load limitation and power losses due to the dilation in filters supplying and replacement.

# MOE Actions Toward Dust Problem

---

- MOE planed to use self-cleaning (impulse) systems (for units which not equipped with this system) to extend the filter life and prevent load restriction (reduction) due filter blockage.
- MOE planed to install a new filer manufacturing plant to cover all the Power plants needs.

# Power Losses Due to Dirt Filters

Table below shows the percentage of power lost due filter blockage for different types of power plant in Iraq.

Units Type	Power Losses ( % )
Frame 5	10 %
Frame 6	10 %
Frame 9	10 %
LM6000 & LM2500	20 %
Siemens	20 %



# Power Added By Combined Cycles

Power Plant	Number of Units	Fuel Type	Current Actual Power MW	Expected Power MW	Power Added MW
Saddir	2	NG	210	315	105
KAZ	2	NG	200	300	100
Najaf	2	NG	190	300	100
Taza	1	NG	220	330	110
S.Baghdad 1	2	HFO	160	240	80
Total			980	1485	495

# Maintenance and Spare Parts

---

- No Long-Term Maintenance Programs were adopted to provide the required spare parts and maintenance.
- Implementation of a CMMS program will contribute in spare parts availability from allover power plants.
- lack of spare parts will affect the maintenance work.
- Lengthen maintenance intervals due to spare parts manufacturing and delivery intervals, such as “ some Siemens and Alstom spares require two years to be available, GE load and accessory gears for Fr5 & Fr6 require ten months and six months for the fuel pumps.
- Dilation in customs clearance affects the maintenance schedules.
- The necessity to train the technical cadres through a certified companies.
- Safety experience shortage at sites because there are no certified experts in this field with international certifications.
- The necessity for a certified inspectors with international certifications.

# Maintenance Intervals According to Fuel Type

Table below shows how is fuel type affect the performance of unit and decreasing maintenance intervals.

	Combustion	Hot Path	Major Overall
Gas	6,000 – 8,000 EOH	24,000 EOH	48,000 EOH
LFO	4,000 EOH	12,000 EOH	24,000 EOH
HFO	2,750 – 5,500 EOH	8,000 EOH	16,000 EOH

# Operation and Maintenance Contracts

## O&M

---

- An O&M contract signature for two V94.2 Siemens units in Saddir GPP is in progress.
- An O&M contract for (Karbala, Hilla and Khairat) GPP is under review and study.
- An O&M tender for Qudus 3 GPP and Zubaidiyah TPP is under announcement.

# Production Comparison between TPP & GPP at Summer Season

Plant Name	ISO/Rated Cap MW	Total Generation at July (MWH)	Average Load (MW)	Fuel Type
Nassiriyah (unit 2) TPP	210	35797	49.7	NG
Nassiriyah (unit 4) TPP	210	87082	121	NG
Hartha TPP	200	74642	104	NG
KAZ GPP	123	73327	102	NG
Bazargan GPP	40	22025.674	31	NG
Al- Qudus GPP	123	56730	79	HFO
Baghdad South 1 GPP	123	50363	70	HFO

# Implementation of Computerized Maintenance Management System (CMMS)

---

- MOE needs a program that monitors & controls preventive maintenance activities according to a national standard as well as a unified system for warehouses
- CMMS (Computerized Maintenance Management Systems) can be used for these purposes.
- CMMS helps in the planning of maintenance activities, budgets, cost monitoring, man power assignments and warehouse management.
- CMMS helps streamline power plants maintenance planning, keeping track of work performance, and monitoring the use of warehouse inventories to ensure that the parts required are available when needed

# Maintenance Management & Implementation Activities at Typical Electricity Utility

**Mission of Maintenance Team:** Implement unit/facility maintenance for improved reliability, availability, efficiency and longer useful life

## KEY PROCESSES

Planning &  
Organization

Training

Implementation

Recordkeeping

## SUBPROCESSES

### Maintenance Training & Development

- Maintenance Training (Procedures, Instruments & Equipment)
- Software Training for Maintenance Operations
- Preventive Maintenance Philosophy
- Condition Monitoring
- Reliability Centered Maintenance
- Current Best Practices
- Technical Database

### Maintenance Support

- Planning & Scheduling
- Maintenance Supervision
- Materials Management
- Engineering Interface with Maintenance
- Reliability versus Maintenance Audits
- Purchasing
- Accounting

### Maintenance Work

- Inspections
- Repair
- Replacement
- Problem Root-Cause Identification & Elimination
- Preventive Maintenance
- Reliability Centered Maintenance

### Maintenance Database Support

- Database of Unit or Facility Maintenance Records
- Warehouse & Stores Inventory
- Approved Maintenance Procedures Info

# CMMS Program Objectives

---

- **Assisting to restoring Iraq's position as leading regional electricity producer**
- **Addressing electricity problems with solutions incorporating latest available technology**
- **Focus on long-term institutional capacity building by developing staff skills, introducing new systems (e.g. practical CMMS software) & modern procedures (KKS coding or other)**



# CMMS Applications Strategy

---

- **Aim to develop self-sustaining capabilities in MoE operations by securing new international agreements to provide technical training and vendor support.**
- **Plan the budget for each maintenance activity, forecast total cost and manpower requirements**
- **Document details of maintenance activities**
- **Check the equipment performance after the maintenance to ensure success of the activity**

# Expected Results

---

- **The CMMS strategy will accelerate & improve maintenance activities and warehouse management, while reducing costs and time required.**
- **It will also help to develop the technical staff knowledge in all areas that concern maintenance such as manpower use, weight of the activity, estimated cost, and the availability of the spare parts.**

# Projected Overall Outcome

---

- **Achieve increased MoE capabilities in the effectiveness of its operations, the cost accounting of its assets, and management of its budgets and resources**

# Implementation Plan

---

The following implementation structure is proposed :

**1- Establish Supervisory committee in the Ministry**

**2- Assign representatives from General Directorates who are specialists in the following fields:**

Turbine maintenance

- Boiler maintenance
- Electrical systems maintenance
- Auxiliary equipment maintenance
- Process units maintenance

**3- Assign teams from the power plants consisting of the following:**

- Team leader
- Maintenance engineer
- Planning engineer
- Finance manager
- Stores manager
- Programmer

# Project History

---

**In 2008**, USAID/Tatweer (MSI) group proposed various commercial CMMS software for evaluation : MaintSmart, Big Foot /CMMS, and Hofinsoft's Dynamics AX EAM & elmpact

MoE Team examined those various CMMS software to compare for the most practical application to power plants and training

**In 2009**, MoE selected MaintSmart CMMS software and initiated training of staff from (4) power plants and personnel from MoE headquarters

- Initial training included teams from:-

Baghdad South GPS ( #1 ) .

Baghdad South GPS ( # 2 ) .

Mussayab GPS.

AlQuds GPS.

And personnel from the MOE Headquarters.

# Project History

---

**In 2010, the Ministry expanded CMMS training to the other gas, thermal, hydro and Diesel power plants to plan for the deployment of CMMS software, and the necessary hardware and IT systems, in 2011 - 2012.**

**When complete, all power plants will be connected to the CMMS system. MoE will be able to coordinate and optimize parts purchasing, distribution, and inventory levels.**

# Work Plans

---

- 1-** Significant efforts have been dedicated to CMMS training , staff development and enhancement of full comprehension of application of CMMS in all power plants.

Training in Maintsmart program was designed to be in three levels :

**The first level** (competency level – almost completed) gave a general idea of the usage and functions of the program for planning, inventory management and work order generation and was done by internet and covered the Directorates as follow:

**The Second level**

is to develop CMMS trainers skills to solve the problems of the users. This training level needs budget support from all directorates to be implemented.

**The third level**

- is to develop CMMS applications experts to better adapt the program to power plants problems, This training level also needs budget support from all directorates to be implemented.

# Work Plans (continue )

---

and there was a serious search for a specialist companies who give training courses in CMMS MaintSmart software for power plants all over the world.

- 2-** All power plant are going to use CMMS MainSmart program , with a unified storage system .
- 3-** All the power plants are going to be connected together by a communications network using updated technology . That will enable the users to share information and the data base.
- 4-** The plan is to set up a unified data base using an MS SQL Server with the Main Computer at MOE/ Head Quarters / Production office operating as a supervisory unit.



# What is MaintSmart?

---

**MaintSmart is a CMMS (computerized maintenance management system) software program.**

**It was specially designed in 1996 by a maintenance manager focusing on ease of use speed of data entry , data analysis and reporting with a user –friendly text.**

**A simple interface was designed to cover the program main sections:**

- Work Orders .**
- Preventive maintenance .**
- Equipment Failure**
- Purchasing & Inventory**
- Reliability Analysis**

# Main Components and Features

---

- 1) Tracking work requests for maintenance work.**
- 2) Warehouse management, purchases, arrivals/use.**
- 3) Preventive maintenance (PM) planning.**
- 4) Assist in scheduling maintenance work actions**
- 5) Tracking labor and parts used plus other costs.**
- 6) Data support for analysis to optimize operations**

## ❖ **Work Order Generation & Performance Monitoring**

- Date-and-time used instead of just date
- Work Order status log tracks work order status changes during life of work order.
- Links work order to cost center and/or account. (Cost center and/or account may be locked to user also).

## ❖ **Inventory Management**

- Filter parts list by vendor or parts group.
- Menus organized and easy to track.
- Inventory system offers good security.
- Provides access to global vendors.

## ❖ Preventive Maintenance (PM)

- Updates a block of PMs and divides the completion time among them or applies the same completion time to all.
- Has ability to change PM interval on an existing PM record.
- Can copy task, task package or job list template to groups of equipment for updates
- Can copy tasks to all equipment in Work Area, Line or entire plant with one button click.
- Converts tasks to generate templates for future use on save.

## ❖ Down Time (Equipment Failures)

- •"Quick Add" failure-cause permission allows basic user to add a failure cause quickly.
- •Converts failure cause descriptions to a typical case (on save) for future use.
- •Spell checker available for failure causes.
- •Time field added to down time (outages) records (in addition to existing date field).

And other features .....

# Benefits of Using MainSmart

---

- **Helps estimate , monitor & control maintenance**
- **Keeps records of equipment maintenance history**
- **Utilizes skilled and specialized trade persons more effectively (archived maintenance data available to all).**
- **Reduces costly maintenance related overtime work hours .**
- **Minimizes emergency maintenance work by proper preventive maintenance and regular inspections**
- **Helps increase equipment availability.**
- **Lowers operating costs.**
- **Helps asset management & prolongs asset life cycle.**
- **Improves control of maintenance scheduling.**
- **Accelerates access to plant or facilities maintenance statistics.**
- **Will help ISO Accreditation.**
- **Assists in conformity with Health & Safety standards.**
- **Helps comply with industry regulatory standards and other benefits**
- **Helps operators recognize maintenance as an integrated essential part of production .**
- **Leads to greater availability of plant or equipment through increased reliability.**
- **Helps analyze trends & reasons for down time**
- **Leads to commitment to planned work .**
- **Highlights areas requiring training .**
- **Involves operators in maintenance of their assigned equipment .**



**Thanks for your  
Kink Attention**